Army Airspace Command and Control (A^2 C^2) and the Contingency Tactical Air Control System Automated Planning System (CTAPS): Is There a Joint Method to this Parochial Madness?

A Monograph
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Second Term AY 95-96

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	23 May 96	MONOGRAPH

4. TITLE AND SUBTITLE
Army Airspace Command and Control (A^2C^2) and the Contingency Tactical Air Control System Automated Planning System (CTAPS): Is There a Joint Method to this Parochial Madness?

5. FUNDING NUMBERS

6. AUTHOR(S)
MAJ Michael W. Drumm, USA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
School of Advanced Military Studies
Command and General Staff College
Fort Leavenworth, Kansas 66027

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Command and General Staff College
Fort Leavenworth, Kansas 66027

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; Distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

SEE ATTACHED

14. SUBJECT TERMS
A^2C^2
Army Airspace Command and Control
JFACC
Airspace
BCE/BCD
Joint Doctrine
Parochialism
Jointness

15. NUMBER OF PAGES
60

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

SCHOOL OF ADVANCED MILITARY STUDIES

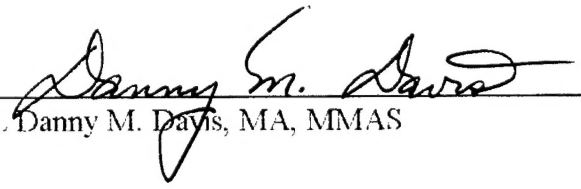
MONOGRAPH APPROVAL

Major Michael W. Drumm

Title of Monograph: Army Airspace Command and Control (A^2C^2) and the Contingency Tactical Air Control System Automated Planning System (CTAPS): Is There a Joint Method to this Parochial Madness?

Approved by:

LTC John C. Rhoades, BS, MA — Monograph Director



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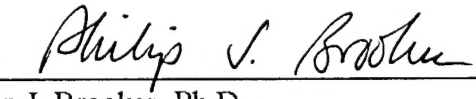

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Accepted this 23rd Day of May 1995

ABSTRACT

ARMY AIRSPACE COMMAND AND CONTROL (A^2C^2) AND THE CONTINGENCY TACTICAL AIR CONTROL SYSTEM AUTOMATED PLANNING SYSTEM (CTAPS): IS THERE A JOINT METHOD TO THIS PAROCHIAL MADNESS?

In a theater of operations, Army access to airspace not under its direct control is difficult to obtain. The increasing number of intelligence, aviation, and long range fires systems organic to the Army, that require the routine use of airspace above the coordination altitude and beyond the fire support coordination line (FSCL), require greater and easier access to airspace usually controlled by the joint forces air component commander (JFACC). Without this access, critical intelligence collection requirements go unanswered, and Army aircraft readiness rates are lowered because of limitations to test flights and the slower delivery of repair parts. The processes and procedures that do exist are the result of after thought and workarounds. Doctrine dealing with the issue is vague and sometimes contradictory.

An examination airspace command and control in a wartime theater of operations is undertaken using the Training and Doctrine Command's (TRADOC) doctrine, training, leadership development, organization, material, and soldiers (DTLOMS) model. The doctrinal evaluation includes a review of Army, joint and Air Force publications dealing with requests for Army use of airspace not under its direct control. Key players and their responsibilities are identified upon creation of a joint task force (JTF), and the subsequent appointment of a JFACC. Deficiencies in training, leadership development, organization, material, and soldier utilization are discussed as they apply to the current A^2C^2 and battlefield coordination element (BCE) structures. A^2C^2 lessons learned and recently published periodicals are examined from operations JUST CAUSE, DESERT SHIELD/DESERT STORM, and from joint exercises since then. The difficulty Army assets experience accessing joint airspace is well documented and, for the most part, remains unchanged.

The difficulties and general lack of familiarity with joint airspace control procedures, and the mission orientation of Army aviation units, has driven them to occasionally ignore the process, increasing the risk of accidents and fratricide. Much of the challenge may be attributed to voids in joint and Army command and control doctrines resulting from service cultural and philosophical differences. Those differences stymie attempts at resolution and perpetuate the cycle of reinventing temporary workarounds at the beginning of every new joint operation and exercise. Finally, recommendations are made that could help reduce the problem, with a more permanent solution requiring the addition of jointness as a basic tenet of Army operations.

CONTENTS

I. Introduction....1

II. Airspace Command and Control....6
Doctrine....6
Army Doctrine....6
Joint and U.S. Air Force Doctrine....12
Training....19
Leadership Development....21
Organization....22
Material....24
Soldiers....26

III. A^2C^2 Lessons Learned....27
Panama....28
Desert Shield/Desert Storm....29
Doctrinal and TTP Deficiencies....31
Personnel/Training Deficiencies....33
Information Exchange Deficiencies....35
Post Desert Shield/Desert Storm....37

IV. Service Perspectives....39
Command and Control....40
Airland Battle....41
Airspace Command and Control Perceptions....42

V. Conclusion....43

ENDNOTES....47

BIBLIOGRAPHY....56

I. Introduction

As the Aerial Exploitation Battalion (AEB)[1] commander came out of his tent, the Battalion S3 yelled at him through the Shamal, a pelting sand storm. All but one of the reconnaissance flights planned for that day were disapproved by the Joint Forces Air Component Commander's (JFACC) Air Operations Center (AOC). The requested flight tracks conflicted with those of U. S. Air Force aircraft on similar missions. "Doesn't anyone in the Battlefield Coordination Detachment know how to negotiate?" he asked, already knowing the answer.

The commander's and the entire battalion's frustration levels had grown immeasurably during the last three days. Only two missions had made it into the Air Tasking Order (ATO) out of the nearly thirty flights planned. "I want you to call the Brigade S3 and let him know what's going on. I'm going over to Wing Headquarters and have another chat with their commander." His battalion was ill-equipped for this information age war. Like every aviation battalion in the U.S. Army, it did not have a terminal for the contingency tactical air control system automated planning system (CTAPS)[2] that could link their airspace requirements with the Air force system that could satisfy them. The battalion did not have the communications equipment necessary for direct input of scheduling requests to the Joint Air Operations Center (JAOC), nor for receipt of the ATO or the Special Instructions (SPINS). He did not even want to think about what he would do if his battalion were not on the same improvised airfield as an Air Force Wing. Still, his week-old questions remained unanswered. How do we know what to ask for if we do not know what airspace is already committed. How do we get our requests to the JAOC early enough to actually have a chance of being on the ATO?

The aviation lieutenant colonel continued to collect dust as he made his way through the familiar maze of CONEX inserts, air-conditioning units, desks, and filing cabinets. He stopped at the far inside corner of a sandy frame tent. Standing in front of a computer terminal currently displaying JSTARS[3] imagery of the theater of operations, the lean O7[4] fighter pilot commanding the Air Wing turned to face him. "Bob, I know why you're here. I talked with my guy at the joint air operations center, and I think we've got an interim solution to your problem. You need to send two of your people, guys real comfortable with your aircraft and intelligence systems and their capabilities, to the JAOC. Have them be your eyes, ears, and mouthpiece for the rest of this war. I'll make my rep there available to your guys until they learn the ropes and can start negotiating for the airspace you need."

"You're right sir, but unless I approach my boss in just the right way with this, he'll think I'm stovepiping to get around the system." They both knew that the "system" for army access to airspace above the coordinating altitude[5] was ill-defined and probably did not exist, at least not in any form that was useful. The Battlefield Coordination Element (BCE) was busy passing and prioritizing land force air support requirements, or interpreting the land battle for the JAOC, and it did not possess the expertise necessary to negotiate for airspace for army aviation units.

The army aviator knew that this solution could only be temporary, but at this rate his battalion was going to sit out the entire war if he did not do something. Maybe this Air Force General could help him after all. The AEB commander managed to smile and thanked the "fighting wing king" for his help and said, "We'll sure as hell give it a try.

"Sir, I'd like to continue getting a copy of the ATO and SPINS from your operations people until we can figure out a way through our own comms."

"All right. I'd appreciate it if your intelligence analysts would continue to give us a new ELINT[6] (electronic intelligence) picture every time you fly. I like that kind of intelligence to be fresh." Nodding, the Army commander covered his nose and mouth with a sand impregnated rag, and leaned out into the merciless wind.

Planning and execution of operational war fighting requires a level of jointness not yet achieved between the Services. Within the branches of the United States military are cultures, dogmas, philosophies, and perceptions of war-fighting roles that stymie attempts at operational level jointness. One such area that typifies this dilemma and eludes most efforts at developing an unambiguous joint doctrine is the issue of airspace command and control. Despite the claims of joint and individual service publications, the doctrine required for the U.S. Army to access airspace outside of its own control is vague and so difficult to use that it is rarely used and occasionally ignored.

The US Air Force spent a tremendous amount of time and energy developing a system to centralize the planning and control of air operations in a theater of war. Air and land based theories of war support the concept of creating an air component commander to centrally control airpower. Joint and service doctrines developed from those theories, and service experiences during and since World War II, lend credence to the JFACC concept. The Air Force expresses considerable concern over the location or even the requirement for a fire support coordination line (FSCL)[7], and the specified and implied restrictions it places on air operations. Restrictions placed on high performance aircraft for access to what the ground commander considers his battlespace, can unduly

hamper the air superiority and close air support battles. A similar concern is growing within the Army about access to airspace above the battlefield. Complex and vague procedures for access to airspace above the coordination altitude, act to limit the ground commander's maneuver space. Although the consequences of the former can be disastrous, the ramifications of the latter are also potentially damaging. They can delay time-critical intelligence collection efforts, lower aircraft readiness as a result of incomplete maintenance test flights, and slow the delivery of urgently needed aircraft repair parts. On the future battlefield, the array of systems the Army will possess to "provide near-real-time target information on enemy short, medium, and long dwell targets, both emitting or passive, throughout the battlespace"[8] will primarily be mounted on aerial platforms, and will require airspace above the coordinating altitude. More significant is the potential for fratricide when combat aviation assets selectively ignore, or are unaware of, the procedures required to transit above or beyond airspace under Army control. Repeatedly, the joint doctrine developed in peacetime to permit the interface of different airspace command and control systems is inadequate during actual combat operations and exercises, as the research shows.

The Army capstone doctrinal manual, FM 100-5, Operations, states, "Ground commanders must have access to sufficient airspace to employ Army helicopters, drones, and airborne sensors."[9] The same document states that the Army will not operate alone. "The capabilities of the US Army are best realized through the integration of its many components working in concert with joint and combined forces."[10] Implied within these two statements is the fact that army access to airspace requires a high level of

cooperation with the other services and, in many circumstances, with foreign armed forces.

The central thesis of this monograph is that the interoperability challenges of the Air Force's contingency tactical air control system automated planning system (CTAPS) and the army airspace command and control (A^2C^2) system are extreme, but not irreconcilable. They are caused by fundamental differences in the culture and perceived roles of the U.S. Army and the U.S. Air Force and result in a substantial divergence between service command and control philosophies and their doctrines.

The monograph assesses current procedures delineated for the Army to access the vertical component of the commander's battlespace.[11] Using the U.S. Army Training and Doctrine Command (TRADOC) doctrine, training, leadership, organization, material, and soldier (DTLOMS) model, it examines doctrine and tactics, techniques, and procedures (TTP) written in US Army, US Air Force, and Joint publications to establish a basis for understanding how the current airspace control systems are supposed to work. It describes where responsibility lies for ensuring Army access to required airspace. Training requirements, leadership challenges, and organizational design, as well as soldier and material requirements driven by the doctrine, are also discussed. Their descriptions aid in analyzing how the systems are resourced, and what provisions were made for the A^2C^2 and CTAPS systems to interface.

The monograph reviews present literature, periodicals, and professional publications including documents from the Center for Army Lessons Learned (CALL), to identify the difference between the doctrinal concepts for access to airspace after establishment of a JFACC, and what actually occurs. Next, the monograph discusses the

differences in service cultures and philosophies that drive divergent doctrines, and likely causes of the failure so far to develop truly joint airspace command and control doctrine.

The conclusion provides specific recommendations for changes to doctrine, tactics, techniques, and procedures that will improve the existing system and it recommends areas for additional research.

II. Airspace Command and Control Doctrine

Army Doctrine

The Principles of War found in FM 100-5, objective, mass, economy of force, maneuver, unity of command, security, and surprise, support the JFACC concept and with it the designation of an airspace control authority (ACA). The principle of war that is violated is simplicity. The promise of a single entity to "plan the air effort, and provide centralized direction for the allocation and tasking of air missions" would appear to simplify the process. However, the requirement to coordinate with other service and/or functional component commanders, makes that process anything but simple. Army doctrine attempts to reduce complexity and hold up its portion of the joint bargain by ensuring that it is consistent with, and expands upon, joint service doctrine.[12]

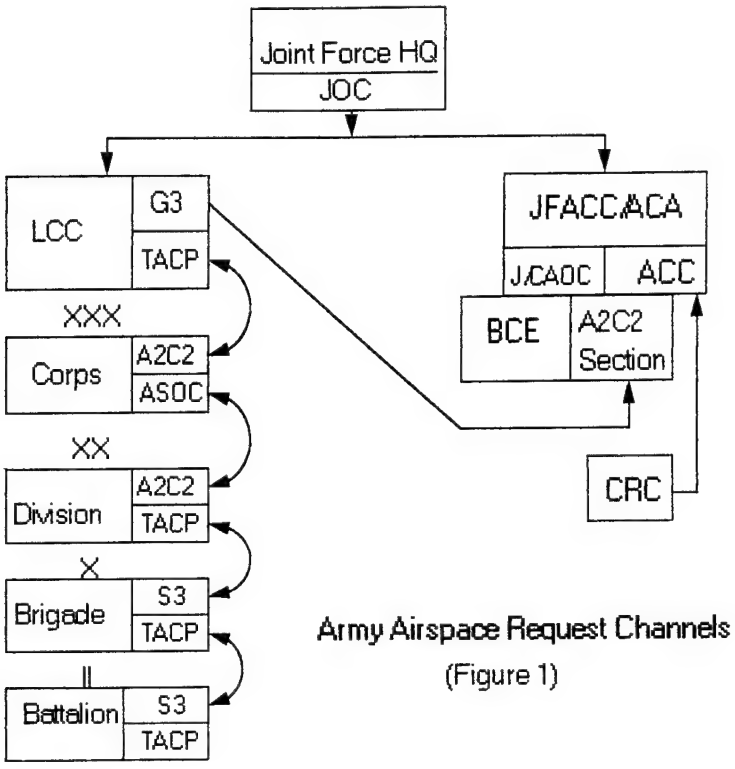
FM 100-103, Army Airspace Command and Control in a Combat Zone, assigns the Army Airspace Command and Control (A^2C^2) system the responsibility for accomplishing the airspace control function. It describes "the A^2C^2 system in terms of its organization, staff functions, and techniques and procedures, as well as its information and interface requirements."[13] When the A^2C^2 system is linked with the airspace control authority (ACA), it becomes a part of the theater integrated airspace control system.

Within the airspace assigned by the ACA to the A^2C^2 system, army aircraft are controlled by a combination of positive and procedural controls. Generally, aircraft performing missions in the main battle area forward of the division rear boundary, operate below the coordinating altitude using terrain flight and standardized movement techniques. The requirement for tactical flexibility associated with the use of attack helicopters as maneuver assets, as well as communications and locational challenges resulting from operating in terrain flight modes, mandate the exercise of procedural controls. Within the airspace between the division rear boundary and the corps rear boundary, the movement of army aircraft is more conventional. Positive control measures are used with the commensurate increase in operating altitudes.

To exercise positive control, the Army maintains an air traffic service that establishes airport traffic areas around designated airports and heliports within the corps rear area. It also operates flight coordination centers (FCC), and flight operations centers (FOC) to provide enroute and flight following services within army controlled airspace. Army aircraft flying into airspace not under army control, either above the coordination altitude, or beyond the fire support coordination line (FSCL), require deconfliction and coordination. The airspace control authority, through the JFACC's joint/combined air operations center (J/CAOC), or the control and reporting center (CRC) can provide those coordination and deconfliction services.

Current army doctrine prescribes two methods by which army aircraft may coordinate to penetrate joint airspace. The first requires the unit desiring to operate in joint airspace to submit a request through the Army chain of command via the A^2C^2 element established at each echelon from battalion through corps. If the request is

approved at each intervening echelon, it is forwarded to the A^2C^2 cell within the battlefield coordination element (BCE). The BCE in turn submits the request to the air component's airspace control center (ACC) of the J/CAOC (Fig. 1)[14].



Army Airspace Request Channels
(Figure 1)

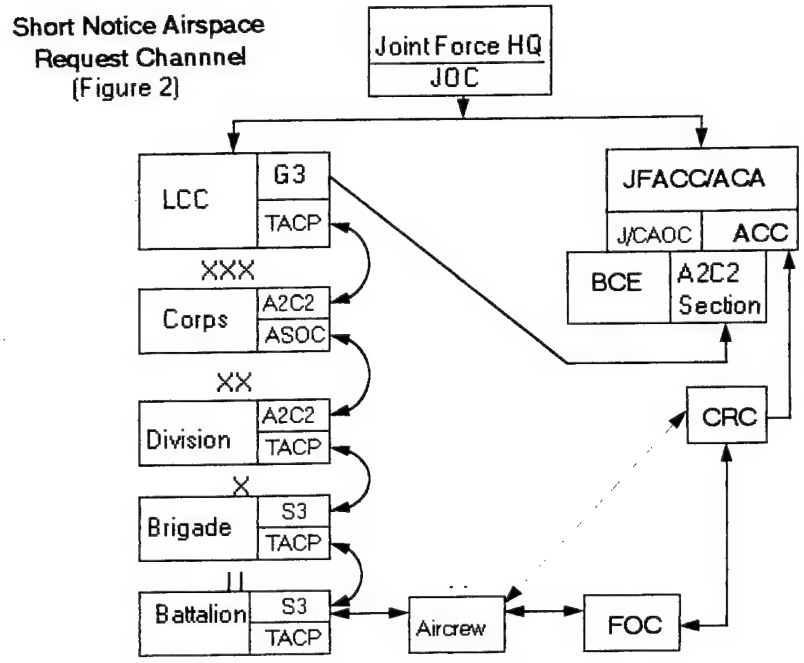
If the request is approved, the ACC establishes a restricted operations zone or other control measure for the flight. It then disseminates the information throughout the integrated airspace control system by publishing it in the air tasking order (ATO).

Two significant obstacles occur when using this procedure. First, the time required for the request to get from the requesting unit to the BCE can take from four to five days.[15] This is based upon unit experiences during the Persian Gulf War and in joint exercises since then. Secondly, personnel assigned to the BCE generally do not possess the expertise or seniority needed to negotiate for airspace use. By the Army table of organization and equipment (TOE), "Currently, there is only one (Army) aviator in the

BCE. The BCE's MOS 15A aviator, helicopter pilot, O-3, does not have the training nor expertise to negotiate and deconflict airspace for SEMA. USAF, USN, and USMC system experts in the grade of O-5 and O-4. . . are Senior or Master aviators with years of experience in planning and flying their particular aircraft system."[16] The proponent for Army doctrine, TRADOC, identified this shortcoming. In a memorandum from the U. S. Army Field Artillery School, to the Commander, U.S. Army Training and Doctrine Command, BG Rigby wrote, "There is no current doctrinal basis for manning or equipping the BCE. Work groups, comprised of commanders and personnel from the BCEs, affected TRADOC schools, and joint service action officers developed the coordinating draft Field Manual 100-13, Battlefield Coordination Detachment, to fill the doctrinal void."[17] Currently, personnel assigned to BCEs lack the training and experience necessary to coordinate for army aircraft to operate in joint airspace.

A second method is used on occasions when time does not permit the processing of a request for airspace coordination during the next ATO and ACO planning cycle. The crew of the aircraft must file a flight plan with the appropriate corps air traffic services unit and notify the corps A^2C^2 element of the mission. When the aircraft takes off, the crew contacts the appropriate FCC or FOC, opens the flight plan, and monitors the FOC/FCC frequency until directed otherwise. "Penetration of the coordinating altitude requires coordination only among the appropriate airspace control elements and users; it does not imply that prior approval must be obtained."[18] The FOC/FCC contacts the air component's control and reporting center (CRC) and passes all related information. If operational requirements dictate positive control of the mission, the aircraft may be directed to maintain contact with the CRC (Fig. 2). "This positive control

link permits other tactical air force elements to transit safely through the restricted operating zone (ROZ)[19] in proximity to the Army aircraft. It also allows the CRC to pass threat warnings in near real time."[20] Though this procedure is in accordance with army doctrine, it has significant drawbacks. They include the requirement for the army air traffic service (ATS) to coordinate for a restricted operations zone (ROZ), and to coordinate for the clearance of the army aircraft through conflicting traffic while it is enroute to the ROZ.



Both requirements must be accomplished quickly because until they are, there is a significant safety risk to all players.

Coordination for the flight of remotely piloted vehicles (RPV) is "accomplished by separating in time and altitude, and by sector (zone), the RPV from other aerial platforms and missions."[21] Establishing restricted operations zones or other airspace procedural control measures reduces potential conflicts. A ROZ over the RPV launch

and recovery site, and a narrow corridor to its operating area pose relatively small obstacles to tactical air movement. The establishment of a much larger ROZ in the vicinity of the FLOT and extending forward to the FSCL, however, poses a greater problem. The situation may require tactical air assets to consider the risk and then request clearance through the ROZ using the principle of see-and-avoid.[22] The airspace control authority may require the RPV missions to be noted on the air tasking order. Army doctrine states that if the RPV mission appears on the ATO with its flight times, altitudes, routes, operations area, and launch and recovery site, there is no need for airspace control measures, such as a ROZ.[23] The chance for a mid air collision would appear to be significant, however, because the RPV's radar and visual signatures are so small, and the volume of aircraft potentially transiting through the RPV ROZ is so high. Limited positive control of the RPV is possible when it is under the direct control of a forward control station and communications are established between the RPV operator and an A^2C^2 element. Current Army doctrine relies on the A^2C^2 system for the timely dissemination of information concerning RPV operations to the J/CAOC.

Army doctrine for accessing joint airspace relies on the A^2C^2 system. The A^2C^2 system is hierarchical and requires a lengthy lead time to process preplanned mission requests. Doctrine for short notice missions requires the requester to launch the mission and obtain airspace coordination while enroute. The procedure may work under visual meteorological conditions in peacetime. During combat operations, however, when air superiority may or may not be attained and the density of high speed air traffic is greatest, the risk would appear to be prohibitive to both army aviation and other tactical air.

Joint and U.S. Air Force Doctrine

Joint Publication 3-52, Doctrine for Joint Airspace Command and Control, states,

> The primary goal of airspace control is to maximize the effectiveness of combat operations without adding undue restrictions and with minimal adverse impact on the capabilities of any service or functional component.[24]

To accomplish that goal, the Joint Forces Commander (JFC) in a theater of operations normally designates a Joint Forces Air Component Commander (JFACC). The JFACC may come from any of the Services, but his selection usually depends upon which Service has the preponderance of aircraft in the theater. Normally, the JFACC is also given the responsibilities of the Area Air Defense Coordinator (AADC), and of the Airspace Control Authority (ACA). Joint Pub 3-52 delineates the JFACC's responsibilities normally assigned by the JFC. The authority to accompany the responsibility is granted by the Joint Force Commander based upon the situation in the theater of operations. As the ACA, the JFACC is responsible for developing the airspace control plan (ACP). The ACP must be coordinated with the host nation(s), and it should include fire support coordination measures. It must be tied to the area air defense plan, as well as coordinated with other joint and combined operational plans.[25] The plan specifies airspace control measures used in the area of operations (AOR) or joint operations area (JOA), and how those measures will be promulgated.[26] The ACA does not, however, have the authority to approve, disapprove, or deny combat operations. "That is vested only in operational commanders."[27] This statement means two different things to the Army and the Air Force. In the Army, the operational commander is the individual in command of a division, corps, or theater possessing organic aviation assets, and controlling his own battlespace. In the Air Force, the operational commander is the

JFACC, who's perspective is theater-wide. This creates an echelon mismatch because the Army places operational command of aviation assets at multiple echelons below the joint forces land component commander (JFLCC), while the Air Force, with its centralized control, places operational command with the JFACC alone.

The US Army's input to the ACP comes from the Land Component Commander (LCC) and his staff. The LCC should provide *expert* representatives from airspace control, fire support and its supporting arms, from air defense, and he should ensure that all (airspace) users are adequately represented.[28] The ACP contains airspace control measures (ACM) which consider special procedures needed by the airspace users, including provisions for rotary-wing aircraft, MLRS, ATACMS, cruise missiles, and Unmanned Aerial Vehicles (UAV). The significance of this process is that the LCC must provide representatives from the required disciplines that are the best in their fields. If he does not, the ACP may not adequately provide for the LCC's battlespace needs. For example, the army aviation representative may be only vaguely aware of requirements for army fixed and rotary wing assets to penetrate the coordination altitude. As a result, provisions for access to the airspace above it may not be included in the airspace control measures, requiring extensive workarounds.

Joint Pub 3-52 acknowledges the diversity of airspace requirements through the listing of fundamental considerations of airspace control in the combat zone. The fundamentals include:

> The need for each Service or functional component within the joint force to operate a variety of air vehicles and weapons systems, both high and low speed, rotary- and fixed-wing (manned and unmanned), within the combat zone airspace control area.

> The need for close coordination and integration of surface force operations, supporting fires, air operations, air defense operations, special operations, and airspace control activities.[29]

The fundamentals are immediately followed by basic principles of airspace control in the combat zone that include:

- o Unity of effort
- o Close liaison and coordination among all airspace users.
- o Procedural control needs to be uncomplicated
- o Flexibility and simplicity must be emphasized[30]

These fundamentals and principles are generally applied to Air Force, Navy, and Marine Corps high performance aircraft, with the needs of the Army only vaguely understood or acknowledged. The centerpiece for the application of these principles is the JFACC's Joint or Combined Air Operations Center (J/CAOC). It is tasked with deconflicting airspace. "To do this, the J/CAOC is augmented with experts from each aircraft system flying in joint airspace. The experts negotiate airspace among themselves, compromise if required, and pass the deconflicted request to the J/CAOC airspace section for inclusion in the ACO."[31] In the event airspace users can not agree, the JFC provides a means to adjudicate differences that cannot be resolved by the commanders and the ACA.[32] Joint Pub 3-52, Doctrine for Joint Airspace Control in the Combat Zone, also states "Matters on which the ACA is unable to obtain agreement will be referred to the JFC for resolution."[33] The Army input to this process is through the BCE. No accommodations are made within the J/CAOC for Army aircraft systems experts.

Much agreement and common understanding exist between the Air Force and the Army in many areas. Unity of effort, simplicity, communication, and coordination required by joint doctrine for the joint use of airspace, however, remain elusive. In place

of a common doctrine to facilitate the Army's use of joint airspace, elaborate ad hoc agreements are developed prior to and during all operations and exercises.

The joint doctrine contained in Joint Pub 3-56.1, Command and Control for Joint Air Operations, focuses on the unified application of air combat assets in support of the JFC's concept of the operation. As it is for JP 3-52, the lead agency for JP 3-56.1 is the US Air Force. This publication's contribution to understanding how the Army accesses airspace outside of direct Army control is in its explanation of the ATO cycle. It also specifies that "*all missions* are subject to the Airspace Control Order of the ACA; however, centralized direction by the ACA does not imply assumption of OPCON (operational control) over any air assets."[34] A sentence in the preface to JP 3-56.1 creates ambiguity by stating that "This publication is authoritative, but not directive."[35] The statement that "All missions are subject to the Airspace Control Order of the ACA" is not a hard and fast rule. This caveat gives the component commanders the option of conforming to Joint doctrine if they think it is appropriate. A directive is defined in JP 1-02, as "A military communication in which policy is established or a specific action is ordered."[36] To prevent what would otherwise be a chaos potentially more dangerous than combat, the individual component commanders generally adhere to the Joint policies established for command and control of joint air operations, as well as for the control of joint airspace.

The orientation of joint doctrine contained in the two joint publications is toward winning the air superiority battle and facilitating air interdiction operations. It is a reflection of the doctrine's authors and their view of the purpose for airspace control. This orientation keeps the doctrine from adequately addressing the requirements of

numerous airspace users from all of the services who do not operate fighters or fighter/bombers.

The argument could be made that air assets not directly involved in the air war do not require special attention. There are relatively few of them and though they may be important to a small number of ground commanders, the development of joint doctrine to support their operations in joint airspace is not warranted. Their operational airspace requirements could be addressed through the multitude of joint tactics, techniques, and procedures (JTTP) manuals hastily developed concurrently with development of a theater of operations.

That may be the wrong lesson to learn, however, especially from the Persian Gulf War. The luxury of an extensive time period before commencement of combat operations afforded the development of JTTPs in the theater. The Army fights as it trains. Operations Desert Shield and Desert Storm illustrated the void in joint airspace doctrine and the resultant lack of training and equipment needed to access airspace not directly under army control.

The US Air Force is the correct proponent for the development of joint airspace control doctrine. It possesses the technical systems and the organization needed for theater-wide airspace control. In almost every foreseeable contingency, it will possess the preponderance of aircraft within a theater of operations. In some circumstances the Navy may possess the preponderance of aircraft initially, yielding to the Air Force the role of ACA after a short period. Not surprisingly and justifiably, Air Force airspace control doctrine reveals the same orientation toward fighter and fighter/bomber operations as in joint doctrine. This orientation focuses command and control

procedures on creating the unity of effort needed to win the air superiority and air interdiction battles.

The Air Force Command and Control structure uses the Theater Air Control System (TACS). It is designed to integrate with Army command and control through the Army Air-Ground System (AAGS), and to be responsive and timely when support is requested. The path developed for requesting Air Force support to ground forces does not also support requests by the Army for access to airspace beyond its direct control. FM 100-103-1/ACCP 50-38, ICAC^2: Multiservice Procedures for Integrated Combat Airspace Command and Control, is a multiservice publication used to facilitate coordination, integration, and regulation of combat airspace during exercises, contingencies, and other operations. It contains both Army and Air Force doctrine and it describes how the individual services plan to control airspace in relative isolation and together. The key to the integration of the army airspace command and control system (A^2C^2) and the theater air control system (TACS), is the liaison interface. Just as in Army doctrine, liaison at the J/CAOC is accomplished by the battlefield coordination element (BCE). Within the BCE the air defense artillery and airspace command and control section works with both the operations and plans divisions of the J/CAOC and schedules preplanned Army fixed-wing aircraft into the ATO.[37] The multiservice publication identifies the section responsible for army fixed-wing scheduling, but not the qualifications of the personnel assigned to it. The void in expertise within the BCE is a serious limitation.

The multiservice doctrine in FM 100-103-1/ACCP 50-38 provides more detailed guidance on the operation of UAVs in joint airspace than Army doctrine. It describes

concepts and protocols that enhance the ground commander's freedom of action with a minimum of coordination. It differs from army doctrine in that it requires UAV airspace management procedures to be included in the airspace control plan (ACP). It is more vague, however, on the procedures used by other manned Army aircraft to access airspace above the coordination altitude. It simply states that "Flight profiles are situation-dependent and are based on the mission requirement, aircraft/sensor capabilities, weather, and the threat."[38]

Army and Joint/Air Force doctrines agree on the need for a single airspace control authority. They also restate tactics, techniques, and procedures that are sufficiently non-specific to earn universal agreement. Most Joint and Air Force airspace control doctrine focuses on airspace control to facilitate the air superiority and air interdiction battles. Army airspace doctrine focuses on resolving coordination issues among its own branches including air defense, field artillery, intelligence, and aviation. The airspace control measures specified in Army manuals orient on the ground commander's battlespace. They center on the use of army aviation as a maneuver asset while operating within army controlled airspace.

This orientation is the result of attack and scout helicopter operating environments, where procedural controls must be used instead of positive control due to communications and altitude limitations. It is also likely that it is a conscious effort on the part of Army aviation senior leadership to have the aviation branch recognized as a full partner in the combined arms team. In fact, Army aviation is a multiple battlefield operating system (BOS) asset executing maneuver, intelligence, air defense, fire support, battle command, and combat service support across the battlefield. The only BOS Army

aviation does not take a direct part in, except for aerial delivery of mines, is mobility and survivability. The Army fixation on aviation as a maneuver asset, constrains aviation's execution of missions in the other BOSs. The Army develops narrow doctrine for all aviation systems, and thereby limits their employment and control methods.

The tactical Air Force uses positive control to the maximum extent possible, and views the air superiority and air interdiction battles as its first and second priority roles.[39] TACS and CTAPS facilitate the Air Force roles of aerospace control and force application. The Army air-ground system (AAGS) and CTAPS facilitate the Air Force role of force enhancement. The Army is the beneficiary of these Air Force roles, but is not a partner in the development of Air Force missions that support the roles. As a result, some Air Force missions, such as the command and control of joint airspace, do not fully recognize the Army's requirement to access it.

Army systems requiring access to airspace not directly under army control, are not adequately dealt with in Army, Joint, or Air Force doctrines. Much of the difficulty experienced interfacing A^2C^2 with CTAPS is the result of unresolved issues. They are issues not pertaining just to A^2C^2 doctrine, but to the training of personnel, the orientation and emphasis of the Army's senior leadership, its organization and equipment, and what is expected of the soldiers assigned to fulfill specific A^2C^2 roles.

Training

The U.S. Air Force Air-Ground Operations School (USAFAGOS) at Hurlburt Field, Florida conducts individual training to provide personnel from all services with a basic understanding of the tactical air control system (TACS) and the army air-ground system. The Joint Combat Airspace Command and Control Course (J-CACC), provides

an understanding of the fundamentals of combat airspace control. "The focus is on joint combat airspace command and control doctrine, techniques, and procedures of each service component."[40] FM 100-103-1 emphasizes the need for liaison personnel to be trained and experienced. It stresses that they are representatives who serve their parent command, and their assigned unit. What is more important, however, is that they ultimately serve the Joint Forces Commander who is responsible for the success or failure of all operations in theater.[41] The formal training conducted at Hurlburt is the only training available to the Army for preparing individuals to assume jobs either within the A^2C^2 system, or within the BCE. It does a credible job of preparing personnel to plan, integrate, and conduct joint and combined air-ground operations. It has limited value, however, in preparing Army personnel in the BCE to negotiate with other service liaisons for the use of joint airspace.

The Army Airspace Command and Control Action Plan dated September 1993, identified several deficiencies within the A^2C^2 system. Among those specifically cited were low training emphasis in A^2C^2 procedures by commanders, and a lack of adequately trained A^2C^2 personnel in active and reserve components. The document stated that A^2C^2 training requirements are not quantified in the training management system.[42] The inadequate training of A^2C^2 personnel relates directly to the inability of the BCE to negotiate and coordinate for army use of airspace apart from its direct control. Similarly, the conduct of A^2C^2 training at a collective level, for example as a part of a major joint training exercise, is all but nonexistent.

The A^2C^2 action plan again identified a serious deficiency in A^2C^2 training. It cited a lack of adequate A^2C^2 play in Army exercises and at training centers, A^2C^2

functions not fully integrated into training exercises and scenarios, a lack of A^2C^2 simulations to support training programs, and a lack of realistic penalties in simulations for substandard performance.

The neglect of both individual and collective training, is the result of the lack of an A^2C^2 concept to support the land component commander's synchronization of the third dimension of maneuver at all echelons across the operational continuum. The current A^2C^2 concept is not adequate for the horizontal and vertical integration of special electronic mission aircraft (SEMA), unmanned aerial vehicles, and deep attack.[43]

Leadership Development

As the individual responsible for exercising command of all assigned land forces, the land component commander (LCC) is responsible for planning and executing ground combat operations. He is also responsible for merging command and control (general) with A^2C^2 for assigned forces. The inclinations and intent of the Joint Forces Commander profoundly effect the array of forces in a theater of operations. Likewise, the understanding of A^2C^2 by the LCC, and his attention or neglect of it, profoundly effect the efficiency and safety of army aircraft combat operations. The LCC's emphasis is felt through each echelon and sets the priority for each lower echelon commander's attention. FM 100-103 states that "the A^2C^2 system is an arrangement of staff elements of each command echelon from maneuver battalion through theater army."[44] Staffs and subordinate commanders will make the A^2C^2 system work if it has their leaders' attention. The requirement for army aircraft to access airspace above the coordination altitude and beyond the FSCL requires leader involvement at all echelons. Leaders need

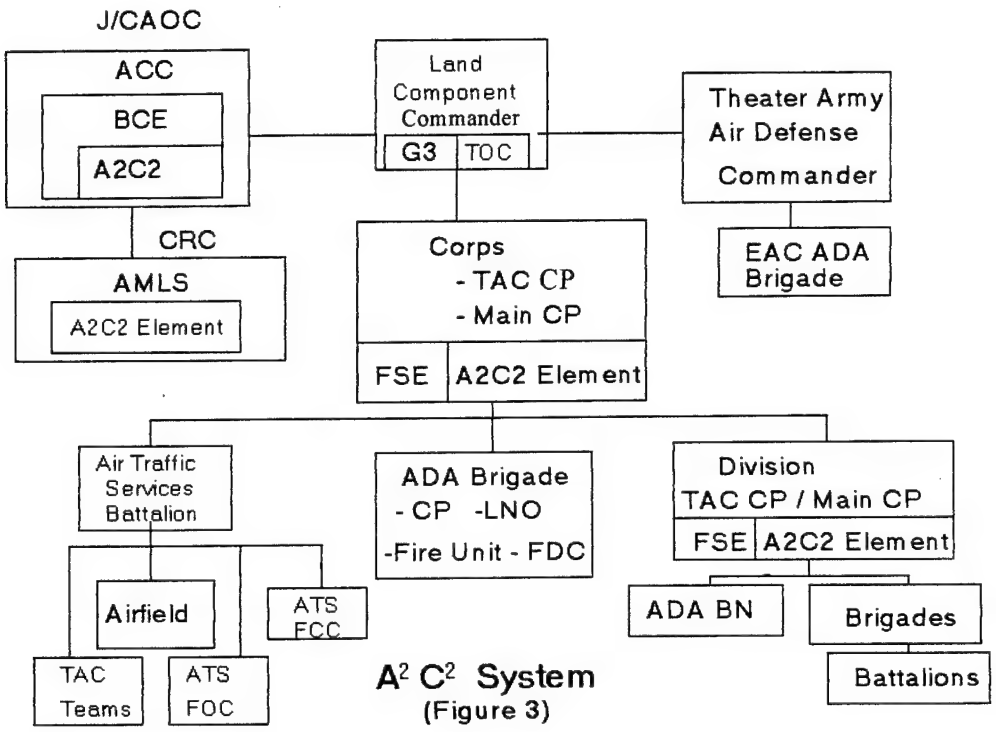
to ensure that procedures are agreed to, that properly qualified liaisons are in place, and that required communications links are established.

TRADOC Pamphlet 525-200-4 states that "In order to overcome conventional force ratios . . .with the advent of a smaller United States ground force, we must condition leaders to appreciate and apply the battlespace construct."[45] Integral to that construct is the vertical dimension of battlespace, and the necessity to have routine and habitual access to it. Without adequate written doctrine and TTPs, leader understanding and involvement is essential to the functioning of the A^2C^2 system. "Most commanders do not place appropriate emphasis on A^2C^2. This lack of emphasis displays itself in lower priorities for staffing G3/S3 Air positions with qualified personnel, and in training individuals and units to perform A^2C^2 missions and functions."[46]

Organization

The A^2C^2 organization and its interface with the ACA, the BCE, are in figure 3[47]. An A^2C^2 element locates within the command posts established by each tactical echelon. At corps and division level, a dedicated A^2C^2 element is resourced by the Army table of organization and equipment (TOE) with personnel. Below division, A^2C^2 becomes an additional task of assigned operations personnel. The lack of a formal A^2C^2 element at brigade level and below impedes the coordination of the maneuver brigade commanders' and aviation brigade commanders' use of airspace above the close battle, and below the coordinating altitude. The air traffic service and Army aviation liaison officers in the division A^2C^2 section fulfill the division commander's requirement to establish and maintain an A^2C^2 system. They do not, however, support the maneuver and aviation brigade's planning responsibilities.

The A^2C^2 elements at echelons above corps are normally found with the LCC or in the BCE and provide the interface required for joint or combined operations. The key juncture between A^2C^2 and the J/CAOC is the BCE. Currently, the BCE is not



A^2 C^2 System
(Figure 3)

adequately staffed to perform its 13 assigned functions.[48] The Army Airspace Command and Control Action Plan specifically cited the limitations of the BCE.

> The size of the A^2C^2 section staff, extent of the airspace management responsibilities, and lack of automated information management support, currently preclude around-the-clock operations of the BCE's A^2C^2 section. The absence of technically qualified and experienced SEMA and UAV personnel in the A^2C^2 section hamper coordination and deconfliction of these airspace users.[49]

The A^2C^2 organization parallels the chain of command. Its structure is a result of the Army view of aviation as a maneuver asset. As just another maneuver asset, there appears to be a predisposition to resist treating aviation in a special manner. The complex coordination issues that arise at the brigade and battalion level are a microcosm

of the complexity of the coordination required between the different airspace control systems. When planning deep strikes for attack helicopters forward of the fire support coordination line (FSCL), the Army views aviation as a fire support asset. The elaborate organizations and communications systems established to aid the fire support battle are brought into action. Aviation assets that are neither maneuver nor fire support are therefore not adequately supported by the current A^2C^2 organization. Without adequate personnel resourcing both in numbers and qualification, the A^2C^2 organization fails to provide adequate airspace command and control.

Material

The critical components within the A^2C^2 system are its communications and automation systems. The A^2C^2 system does not have a dedicated communications net, but uses existing secure and nonsecure voice (single channel or multichannel VHF-FM, VHF-AM, HF, and UHF) radios, wire, satellite, and messengers. Communications between the A^2C^2 system and airspace users are primarily through the Army air traffic service (ATS). Improvements to the system are ongoing and include the fielding of the single channel air-ground radio system (SINCGARS) and mobile subscriber equipment (MSE). The most significant enhancement to the communications and automation systems could come with the fielding of the maneuver control system (MCS).

MCS promises to substantially improve the exchange of data and communications between all Army command and control nodes, including A^2C^2. MCS will assist A^2C^2 elements at each echelon by connecting all maneuver command posts and by integrating air defense, intelligence and electronic warfare (IEW), fire support, and combat service support (CSS) functions. In addition, MCS is planned to interface

with the contingency theater air control system automated planning system (CTAPS), in accordance with the Joint Chiefs of Staff standard for ATO generation and dissemination. The Navy, Marine Corps, and the Air Force have expended tremendous efforts to ensure that CTAPS meets the needs of the JFACC.[50] The MCS interface with CTAPS will enable Army users at all echelons to receive airspace control products such as the air tasking order (ATO), the airspace coordination order (ACO), and the special instructions (SPINS). MCS will not provide Army airspace users the capability to input directly to CTAPS and thus become directly involved in the ATO generation process. An argument for this limitation could be based on the idea that Army aviation is a maneuver asset, and must not circumvent the chain of command. However, the MCS/CTAPS link could be an indispensable coordination tool.

The first part of the objective system for an automated data link between the Army and the Air Force at the theater level, is between the standard theater army command and control system (STACCS) in the BCE, and CTAPS in the air operations center (AOC). The second part of the objective system would link CTAPS in the air support operations center (ASOC) with the maneuver control system (MCS) at corps. Currently, STACCS does not provide A^2C^2 information and there is no automated interface between STACCS and CTAPS.

The coordination required on the contemporary battlefield mandates the high speed two way access to information that only an automated link can provide. While the other services are fully on board, the Army will have a very tough time employing its aviation assets, especially outside of Army controlled airspace in support of the LCC's war plan. Without an automated link, coordination for joint airspace use will require the

Army to process, by hand, all of its requests to the J/CAOC. The resulting time lag will inhibit rapid adjustments to inevitable changes in the tactical situation. To complete their missions, Army aircraft will again circumvent or ignore the airspace control rules, increasing the risk of accidents and fratricide.

Soldiers

Soldiers and officers assigned to the A^2C^2 element on a division or corps staff must attend the air-ground operations school (AGOS). The additional skill identifiers (ASI) of 5U (air operations officer) for officers and Q8 (tactical air operations) for non-commissioned officers, listed on the appropriate table of organization and equipment, are a prerequisite for assignment to a division or corps A^2C^2 element. Currently, those additional skills are not tracked by the personnel management system. Many of the soldiers filling positions in the A^2C^2 system are not qualified and must receive on-the-job training to perform their jobs.[51]

Possibly more significant to the ability of the A^2C^2 system to function, is the assignment stability of the officers and soldiers filling A^2C^2 positions. In his *Air Defense Artillery* article, "Army Airspace Command and Control," Captain Hector R. Valle observed that "commanders are reluctant to assign and designate personnel to A^2C^2 positions because they perceive them as unimportant. Liaison personnel routinely were absent from their positions, justifying their absences with more critical tasks elsewhere."[52] Additionally, there is a trend to assign personnel as fillers to A^2C^2 slots while they await a permanent change of station or attendance at some non-A^2C^2 related school. "This tendency of short-term assignments in the A^2C^2 affects the ability of the cell to work as a team and to circulate timely and accurate information."[53]

Though training is available for Army airspace managers, there is currently no system to ensure trained and qualified personnel are in the correct positions. There is also a reluctance by commanders to give up personnel for long term assignment in an A^2C^2 position. The combined affects of these limitations certainly contribute to the deficiencies of the A^2C^2 system. "Our battlefield capability is unlimited because of the potential of our soldiers. When they understand what is supposed to happen and why their leaders want a particular outcome, they are unstoppable."[54]

The doctrine, training, leadership, organization, material, and soldiers that make up the current A^2C^2 system, and thus provide the means for Army users to access joint airspace, are in various states of order and disarray. The strength of the system lies in its proximity to the chain of command and the soldiers who man it. Its weaknesses lie in its under-resourcing, a general lack of command emphasis, and an unwillingness to change. The disfunctionality of the A^2C^2 system directly affects how well Army users of joint airspace do their jobs.

III. A^2C^2 Lessons Learned

The roots of the current JFACC and airspace coordination authority idea, are found as far back as World War II with the realization that a unified air campaign can create a devastating synergy. In Command and Control of Joint Air Operations: Some Lessons Learned from Four Case Studies of an Enduring Issue, the authors refer to the Solomons campaign. They state that "those closest to combat quickly overcome burdensome command arrangements when faced with the prospects of military disaster, and that command and control issues become more contentious the farther one gets from the fighting."[55] The A^2C^2 and joint airspace lessons learned from Operations Desert

Shield and Desert Storm follow that logic. While participating in the planning for, or the execution of combat operations, cooperation was common. Deficiencies in A^2C^2 doctrine, training, leadership, organization, material, and soldiers were overcome through tenacity and the need to replace burdensome command arrangements with more realistic procedures. Much of the conflict surrounding airspace command and control occurred, and still occurs, at echelons well above the people who actually must make it work.

Panama

In December 1989, Operation Just Cause became the first opportunity to exercise the A^2C^2 doctrine contained in FM 100-103 (October 1987) during combat operations. The development of detailed procedural airspace controls over a lengthy preparation and rehearsal phase, however, negated the requirement for the kind of joint airspace controls required by longer combat operations such as Desert Storm. "We worked on the basic operational plan for the past six months developing the C^2 system and the airspace control system."[56] Only preplanned flights over preplanned routes were permitted into Panamanian airspace during initial assault operations. Active control of flight operations did not use, or minimized the use of, ATC radars and radio communications. Overall airspace deconfliction was provided by an Air Operations Center containing Air Force, Army, and Special Operations representatives. The extensive preparation and rehearsal, however, minimized the requirement for deconfliction.

There were no midair collisions or even reports of near-collisions. That fact is significant because there were 185 fixed-wing and 173 rotary-wing aircraft operating under night vision goggles in a relatively small area.[57] Care should be taken, however, in deriving from those statistics that airspace deconfliction and coordination may be

exclusively based on procedure. Just Cause was closer to what was formerly termed a low intensity conflict, and the aviation assets involved in it operated more like special operational forces than conventional forces. The lesson to learn from Operation Just Cause is that in joint operations of very short duration, A^2C^2 may not need an elaborate interface with the J/CAOC. The level of coordination is strictly a function of the theater of operations and the JFC's concept of the operation, including its projected duration.

Desert Shield/Desert Storm

Operations Desert Shield and Desert Storm (DS/DS) were the first true tests of the A^2C^2 concept and how it would interface with the JFACC's combined air operations center (CAOC). During DS/DS the Army flew thousands of scheduled fixed-wing missions in Air Force controlled airspace.[58] Most were flown during the Desert Shield portion and were conducted to collect intelligence on the developing battlefield and array of enemy forces. Early on, however, the deficiencies in the Army's concept for airspace command and control, and the ability to interface with the joint concept became apparent.

When XVIII Airborne Corps began deploying its helicopters and fixed-wing aircraft into the theater, airspace conflicts arose. CENTAF, the Central Command's Air Force Component, wanted all rotary-wing flights included on the ATO. What the Army wanted was control of its own airspace including mission scheduling. There was reluctance on the part of the Army to place its aircraft on the ATO for three reasons: first, because of the ATO's relatively long planning cycle; second, because of what the Army perceived as inflexible mission information requirements; and third, because of unrealistic reporting requirements that could never accommodate Army helicopters and

their typical mission profile.[59] Additionally, the airspace coordination authority was reluctant to provide airspace for Army intelligence collection aircraft. All airspace initially provided to the JFACC by Saudi Arabia, was planned for Air Force use with no provisions made for the Army. Eventually, a coordination altitude was established at 500 feet throughout the theater, but each Army reconnaissance and surveillance flight above the coordination altitude had to be individually negotiated.[60]

The lesson learned from the first part of the Persian Gulf War for a JFACC, regardless of his service, is that the Army possesses large numbers of rotary-wing and fixed-wing aircraft. Consequently, the Army will require access to airspace both under its own control and outside of its immediate control to support the Land Component Commander's and the Joint Force Commander's battle plans. The lesson learned for the Army is that there is a JFACC and there is an airspace coordination authority (ACA) who assigns responsibility for airspace control. To facilitate the coordination effort, a full time airspace manager is required on the ARCENT staff, as well every other major command's (MACOM) staff.

During Operation Desert Shield, as the theater of operations developed and large numbers of aircraft from each service and several nations arrived, the airspace became crowded. While Army rotary-wing aircraft were able to confine the bulk of their operations and training missions to the airspace below the coordination altitude, other airspace control procedures were inefficient or ineffective. The Air Force used its computer assisted flight management system (CAFMS) very successfully, but the Army had no efficient or timely method of disseminating the air tasking order (ATO), the airspace coordination order (ACO), or the special instructions (SPINS). Part of the

problem was the inability of Army's air traffic service to communicate flight information. The deficiencies of the A^2C^2 system and its interface with the JFACC's system for airspace command and control may be separated into three broad categories: a lack of doctrine and tactics, techniques, and procedures (TTP); personnel and training deficiencies; and inadequate information exchange.

Doctrinal and TTP Deficiencies

Doctrinally, the Army thought it was prepared for DS/DS. The Army's capstone doctrinal publication for airspace command and control, FM 100-103, however, only touched on the requirements for Army aircraft to operate in a joint theater of operations. The Army was unprepared for the level of coordination that was required. "Many planners and managers felt that airspace procedures and methods emplaced by the air component commander were too restrictive for Army aviation. They hampered flexibility and gave too much control to the Air Force."[61] It was also felt that the existing system contained in FM 100-103, however, could be made to work if requirements could be better anticipated, and if there was a better real time interface with the approving levels.[62] The anticipation of requirements is a function of the personnel assigned to do that job and the depth of their training. The absence of an overall A^2C^2 concept made commander's leery of assigning their best trained and qualified people to airspace management positions. The Army's doctrinal interface with the "approving levels" was and still is the battlefield coordination element (BCE). It was incapable, however, for numerous reasons, of near-real time interface with the larger airspace system.

Many Army personnel also thought that control of forward airspace (corps sector) needed to be defined better and the corps given more control over the airspace above it,

at least to the maximum altitude of its organic ordinance.[63] This Army, Air Force, and Joint doctrinal conflict has not been resolved, and became very obvious with the requirement to operate in a joint environment.

The Army's doctrinal void created a climate of work arounds and compromises. Every aviation commander wanted to ensure that all assigned missions were accomplished. "Aviation units that had the least problems with A^2C^2 were the ones that selectively ignored airspace requirements. No mid-air collisions occurred, nor were any aircraft shot down by friendly fires; . . . this is strictly situational and in the next conflict, the same may be very hazardous."[64] Army air defense assets recurringly found IFF (identification friend or foe) use among rotary-wing aircraft very poor. "Many aircraft either did not respond with the proper code when challenged, or responded with an improper code. In the corps area, there were between 100 and 200 aircraft flown daily without valid IFF. Airspace control measures were similarly not followed."[65] Though the criticism that this was a discipline problem has some merit, there were reasons for noncompliance. "The system was very complex and the IFF computer could not hold all of the information."[66] The Army doctrine written to ensure compliance with joint airspace procedures was not usable. The joint doctrine was general enough to give commanders latitude in terms of compliance. The Air Force doctrine, which was thorough, was fast-mover oriented, complex, and totally unfamiliar to the Army aviation community.

For Army aviation assets that had to routinely operate in airspace not under army control, the learning curve was especially steep. The request procedure for the use of joint airspace was unknown, primarily because an occasion had never arisen requiring its

use. Participation in corps level exercises by intelligence units employing aviation assets had only required coordination with the civilian air control structure. Though some of the units participated for years in the Peacetime Aerial Reconnaissance Program (PARPRO)[67] scheduling process, they had no experience with airspace coordination authority (ACA) requirements. Once the extent of the requirements were known, however, TTPs were established including the posting of semi-permanent liaisons to the JAOC, and an informal method for receiving airspace control documents such as the ATO, ACO, and SPINS.

Personnel/Training Deficiencies

Since the requirement to operate in a joint airspace control structure was not emphasized in Army doctrine, the qualifications, training, and numbers of personnel assigned to the BCE and in the A^2C^2 elements at each division and corps, were not adequate. Augmentees were required at the BCE to allow for around the clock operations. At the beginning of DS/DS, the BCE table of organization and equipment (TOE) only authorized one officer and one non-commissioned officer for handling airspace issues. Both U.S. corps submitted hundreds of airspace requests, primarily for special electronic mission aircraft (SEMA), to support ongoing operations. "The efforts of two people were required to keep up with required inputs."[68] The BCE had to be augmented with two additional people per shift. Augmentees came from air traffic control units and other A^2C^2 elements. Even with the additional people the BCE was unable to negotiate and deconflict airspace use with other service representatives.

The only people familiar enough with the aircraft and intelligence systems, to work airspace issues for the SEMA units, were SEMA aviators. The requirement to

provide augmentees/liaisons to the BCE and JAOC caused units to draw from the very limited pool of SEMA aviators in the Army.

> On the joint side, several very difficult Army aviation and airspace management issues developed which required many Army units to provide liaison resources out of hide. . .major aircraft/airspace issues, that existed between coalition and joint (especially Army and Air Force) could have been avoided and better resolved by having these liaisons authorized, equipped, trained, and in place prior to Desert Shield.[69]

Additionally, there was a general lack of airspace expertise at the ARCENT and corps staff levels. "The ARCENT G3 did not have any knowledge of PARPRO rules or how to deconflict airspace for the tracks to be flown."[70] Likewise, the ARCENT G2 lacked personnel knowledgeable in airspace deconfliction matters. Eventually, "The CM&D (collection management and dissemination) section established a G2 Air section. . . This section coordinated and adjusted, as required, all flight tracks, for the corps' aerial exploitation battalions."[71] The expertise for this newly formed section , also came from the limited pool of SEMA aviators.

The requirement for airspace deconfliction expertise throughout the chain of command, from the military intelligence brigade, to the corps, to ARCENT, and to the BCE, were unforeseen by the Army. The requirements exceeded the capability of units to provide personnel out of their organizations. Out of necessity, an abbreviated system was established. In the case of the 15th AEB, one permanent and two rotating liaisons were established at the joint air operations center (JAOC). The liaisons worked closely with both the BCE and directly with Air Force and other service representatives in the JAOC. Each time a mission tasking was sent to the AEB from the military intelligence brigade, a copy was sent to the liaisons at the JAOC. Simultaneous planning and coordination began immediately and the time required for a mission to be deconflicted or

changed was reduced to a fraction of the four to five days previously required. It was now possible to alter mission track locations, times, and altitudes within hours or minutes instead of days.

The non-doctrinal solution of placing battalion level liaisons at the JFACCs JAOC was viewed skeptically, however, by the commander of the BCE and members of the chain of command, since it involved direct interaction between Army and joint organizations of significantly different echelons. Though the personnel qualifications and training requirements for liaisons and persons knowledgeable in airspace deconfliction became obvious, these particular lessons from DS/DS have still not been learned.

Information Exchange Deficiencies

Because Army doctrine did not adequately recognize the requirement for its aviation units to conform to joint airspace controls, the equipment and procedures required for the exchange of information between units trying to fly and the airspace control authority were not in place. "Army aviation at all levels was disconnected from the Air Force distribution system. Forward deployed fixed-wing and helicopter units as well as echelon above corps units operating from fixed base locations did not have ready access to contingency airspace force-management system (CAFMS) terminals."[72] The two way flow of information was irregular and infrequent.

The Air Force used its computer assisted force management system (CAFMS). The software and hardware capability of CAFMS gave planners the ability to "build the ATO, automate the deconfliction and integration of air assets, and transmit the final product to users in the field."[73] The Army and other services were not equipped with the

means to link to CAFMS. Air Force computer systems used to plan and execute air operations were not intended to address unique requirements of joint and multinational air operations in a contingency theater.[74] Paper copies of the ATO had to be generated and hand delivered to ships at sea and coalition forces. "Some Army aviation units were forced to operate in a system without adequate equipment. Army aviation units were forced to collocate or commute daily to Air Force units which had CAFMS terminals to input and extract mission information necessary to fly in theater airspace."[75]

The inability of Army aviation units to communicate directly with the system controlling all theater airspace created dangerous conditions through noncompliance with frequent changes to the ATO, ACO, and SPINS. Units requiring routine access to airspace above the coordinating altitude had a particularly difficult time.

> Vital mission data, such as mode I and mode II codes, time on target and station times, special electronic mission aircraft tracks, and air transit route approvals had to be obtained through secondary sources. Pertinent mission information was not obtained until after mission windows had been closed in some instances.[76]

Without the CAFMS link, delivery of the ATO to units in the field was very sporadic and it was never timely. Units did not know what activities were planned for the airspace in their sector. If a unit needed the use of airspace above the coordinating altitude to conduct an EH-60 Quickfix mission, a request for the designation of special use airspace was required. The long lead time for airspace requests resulting from inadequate communications links caused the ATO to not be received prior to the mission execution time. "Often the unit operated in airspace without a firm authorization to do so."[77] Numerous work arounds were eventually established before the cessation of operations including the use of laptop computers and STU-III secure telephones to receive and

redistribute the ATO. Units not able to access commercial telephone lines, attempted to comply with the ATO, ACO, and SPINS whenever they had them.

The communications difficulty significantly slowed the airspace request process for most of the Army operating in DS/DS, and prevented many Army aviation units from being able to comply with the basic airspace management and deconfliction measures established by the airspace control authority. Though the lessons learned are numerous, exercises and operations since DS/DS indicate little change.

Post Desert Shield /Desert Storm

In the years since DS/DS, attention has been given to airspace coordination and deconfliction with limited success. Joint Exercise Ocean Venture '92 involved an aerial exploitation battalion (AEB) supporting the XVIII Airborne Corps as the JFC. An informal liaison was established between the AEB and the joint air operations center at Pope AFB, much as was done during DS/DS. The two liaison team members were able to function as "fraggers"[78], and work to deconflict airspace with the other fraggers from the USAF, USMC, and Navy. Though the AEB fraggers were successful in attaining airspace for each mission, and in negotiating for changes to prior and short notice mission requests quickly, their presence was still not in accordance with Army doctrine. Their ability to communicate with the AEB and with the intelligence brigade tasking the AEB, depended on commercial telephone lines. The success they achieved was a function of individual hard work and a can-do attitude. Doctrinal, personnel, and communications issues were still unresolved.

In 1993 the Army participated in a recurring Air Force computer simulation exercise called Blue Flag. Significantly, the simulation included notional intelligence

reports generated by Army SEMA aircraft including RV-1D Quicklook and OV-1D side-looking airborne radar. The BCE established to represent the Army's involvement focused on four functional areas, logistics, intelligence, plans and operations, not on airspace deconfliction for the aircraft providing intelligence.[79] While Blue Flag focused on Air Force and Army synchronization and coordination fires and close air support, an important aspect of the simulation, the deconfliction of airspace for Army aviation use, does not appear to have been addressed.

Current airspace control measures in Bosnia-Herzegovina reflect TTPs developed for that peace-keeping operation. The requirement for all aircraft above and below the coordination level[80] to be on the ATO will again require work arounds. The Army aviation units deployed there are still not equipped with a link to CTAPS.

Examination of A^2C^2 annexes to two corps level operations plans written in 1996 reveal a continuing neglect of the requirement to obtain airspace for each corps' organic aerial intelligence collection assets. Both the XVIII Airborne Corps' DEFIANT DRAGON operations plan and the Battle Command Training Program's X Corps operations plan 96-13, fail to address the link that must be established between the corps A^2C^2 element and the LCC or the air operations center. Personnel and equipment requirements for that function are not addressed. In the XVIII ABC annex, an air traffic control unit is directed to be prepared to provide liaison to the Air Force Control and Reporting Center (CRC). Neither annex, however, addresses the airspace requirements of corps fixed-wing aircraft or unmanned aerial vehicles.

The issue of airspace deconfliction for Army aircraft, both manned and unmanned, operating outside of Army controlled airspace is not resolved. During Prairie

Warrior 1995, an elaborate exercise involving a consortium of computer simulations and the entire student body of the United States Army Command and General Staff College, airspace deconfliction for simulated UAV tracks proved so difficult and time consuming, that the student equivalent of the JAOC gave blanket authorization to flights anywhere in the theater. Their inability to apply current doctrine and TTP, or quickly and effectively deconflict airspace requirements, is not an isolated incident.

Though of secondary importance to the requirement to coordinate the use of airspace for fires and CAS, failure to deconflict airspace use among all users on the host of related supporting missions flown by Army aviation, invites accidents and fratricide. Doctrinal, personnel qualification and training, and communications deficiencies are well documented. Command emphasis for attaining solutions, however, is lacking.

IV. Service Perspectives

Approved by Congress, the roles and missions of the services are not always easily compared. The Army sees its primary role "as an element of deterrence; but should hostilities arise, the Army will be the sustained land combat force that achieves decisive victory and maintains America's security."[81] Specific roles of the Army are as prescribed by law under Title 10. Army missions to accomplish the roles "are assigned to the Commanders-in-Chief of combatant commands by the Secretary of Defense in accordance with the Unified Command Plan and the National Military Strategy."[82]

In contrast, the Air Force performs four basic roles: "aerospace control, force application, force enhancement, and force support."[83] The Army's role is broad and implies flexibility. The Air Force's roles are relatively specific and provide a context for every mission the Air Force performs. The service's doctrines correspond to the

character of these roles. Army doctrine focuses on command and control of subordinates, while Air Force doctrine focuses on centralized command and decentralized execution.

The Air Force was at one time a part of the Army. The two services had different experiences in their evolution since their separation, however, that "led to different doctrines, different interpretations of the unity of effort principle, and largely incompatible views on the unity of command and the conduct of joint operations."[84] Today, there is a significant philosophical divergence between the Air Force and the Army. It centers on the service's concepts for command and control, and the Airland Battle.

Command and Control

The Army conceptualizes command as a directive process that relies on the ability of the commander to infuse within his subordinates the commander's will and intent. A key premise to the concept is that of reliable subordinate behavior. Control for the Army, is the process that monitors the subordinate's behavior for deviation from the commander's will and intent, and takes corrective action if it is necessary. "This process is regulatory: its premise is unreliable subordinate behavior. Unreliable behavior in this context. . . will normally be inadvertent, resulting from different perspectives of the battlefield, inattention, a lack of understanding of the commander's intent -- or the fog of battle."[85] These concepts define the Army's perspective of how it "must coordinate hundreds of thousands of entities to ensure tactical and strategic coherence on the battlefield."[86] In an effort to conserve manpower slots, the Army has not recognized any echelon above corps since 1973, virtually eliminating the theater army level. As a result,

Army doctrine focuses on corps level operations and creates a mismatch of echelons between the Army and the Air Force that conflicts with basic airpower doctrine.

The Air Force concept of centralized control is key to positive control of aerospace power. "Centralized control is established under a single air commander who directs the employment of forces at a level of command from which the overall air situation can best be judged."[87] From the Air Force perspective, the theories of Douhet and Mitchell as well as experiences in North Africa and Normandy argue heavily in favor of not parceling out combat air assets, but controlling them centrally toward a unified objective. The airspace command and control doctrines of the Army and the Air Force are based on their different command and control philosophies and doctrines.

Airland Battle

The Army's concept of Airland Battle extends the battlefield to permit the ground commander to influence his future close fight, by engaging uncommitted enemy units before they close. The deep fight sets the terms for subsequent close operations. To conduct the deep battle the ground commander must use systems that can identify and attack enemy forces at extended ranges. Assets available to the ground commander include organic systems such as the multiple launch rocket system (MLRS), the advanced tactical missile system (ATACMS), and attack helicopters such as the AH-64 Apache and the RAH-66 Commanche. He may also be able to nominate certain deep targets for reconnaissance collection and/or attack by the Air Force. The Army concept for the deep battle includes Air Force assets. The Air Force sees the Army's deep battle as a diversion of its centralized control of air interdiction assets that will result in less than optimum destructive effects on the enemy.

Airspace Command and Control Perceptions

The differences in basic service command and control doctrines are reflected in differences in their airspace command and control doctrines. The different organizations, equipment, and procedures in each illustrate that point.

Army airspace command and control exists to deconflict the use of the vertical dimension of the ground commander's battlespace. It coordinates the various BOSs which may affect that vertical dimension by creating a new function within the existing chain of command at all echelons. The command and control structure for airspace command and control is hierarchical, but its role is limited to that of coordinator, not as a tasker. The Army's parceling of terrain to match its hierarchical structure, is matched by the A^2C^2 structure. The same terrain-based control measures used for ground maneuver forces, form the basis for A^2C^2 and Army airspace control measures. Army aviation assets such as intelligence collection platforms, combat service support assets like MEDEVAC and heavy lift, and even attack helicopters performing the equivalent of a fire support mission by conducting a deep attack, do not easily conform to ground-based maneuver control measures and are exceptions that the current system does not handle well.

Air Force airspace command and control exists to facilitate the air superiority, air interdiction, and close air support battles. The use of airspace under the air component's control by exceptions such as Army intelligence platforms, deep attacks by helicopters, and even intratheater airlift by airmobility command assets are tolerated, but not handled efficiently. The Air Force's airspace command and control doctrine, like the Army's

airspace command and control doctrine, was developed to fulfill service requirements with minimal compromise for extraservice or joint needs.

The theater wide view the Air Force takes to prosecute its portion of the JFC's battle plan, is juxtaposed to the corps and below level view the Army takes for prosecuting its portion of the JFC's plan. Jointness is not a fundamental concern for the development of service airspace command control doctrines; compromise and workarounds are the result.

V. Conclusion

The Chairman of the Joint Chiefs of Staff stated that "he is unimpressed with the level of joint warfighting, particularly in terms of doctrine, training, requirements, and readiness."[88] His comment was a result of the lack of a theoretical foundation to direct the development of jointness in those four areas. The Goldwater-Nichols act gave the concept of jointness bounds within to operate and the purpose of enhancing the effectiveness of operations. Development of jointness so far, however, has been through experimentation. "Unfortunately, this has led the Joint Staff, combatant commands, and services to derive coordinated joint process (in doctrine, training, requirements, et al.) that are stovepiped - isolated from one another instead of thoroughly integrated."[89]

Likewise, the development of service doctrines to provide airspace command and control appear to be stovepiped. Without a theoretical foundation for the development of jointness, doctrines, training, and equipment, evolve to support individual service needs with little regard given to extraservice requirements. There is a need for an overarching airspace command and control doctrine. As it is currently written, joint airspace command and control doctrine resembles children who are parallel playing in that they

are in the same room, sitting close together, but are involved for the most part in separate activities, with only occasional communication between them. The Navy's fleet-defended airspace, the Marine Corps' amphibious operations area, the Army's battlespace, and the Air Forces' theater wide concept for aerospace control, are attempts to control, among other things, the one medium they all share -- air. In the case of the Army and Air Force, the one interface agreed to between them for coordination of their airspace command and control is the battlefield coordination element. But, it is not properly manned or equipped for the task.

With the development and publication of a truly joint airspace command and control doctrine, the services may begin to develop their parts to maximize the contributions they bring to the joint fight. TRADOC Pamphlet 525-5, Force XXI Operations, states that "The Army must continue to improve its contribution to joint and interagency operations. To fully execute full-dimensional operations throughout the depth, height, width, and time of the particular battlespace demands use of other service assets."[90] To reconcile the services' different airspace command and control doctrines will require the development of a new culture, a joint military culture. Along with this joint culture will come joint philosophies and doctrines to support the military forces of the twenty-first century. In the interim, however, steps may be taken to improve the existing complex and often difficult system of airspace command and control:

The concept and organization of the JFACC's, J/CAOC, must make provisions for Army airspace coordinators. That involves the reservation of positions within CTAPS software for the integration of Army data links, as well as the intellectual and attitudinal

adjustment necessary to recognize the Army's requirement for access to all of joint airspace.

The Army must recognize the need for its aviation assets to routinely operate in airspace outside of its direct control and must develop doctrine to support it. The development of that doctrine will require the recognition of aviation as a multiple battlefield operating system asset, with requirements for the same level of communication and coordination as fire support, intelligence, and combat service support. It must provide the means for those assets to coordinate directly with the service appointed as the JFACC. Those means include the following:

-Army developed training and qualification standards for its A^2C^2 personnel. Reliance on the Air Force schools alone is insufficient. They do not adequately address Army aviation's requirements to access joint airspace.

-Acquisition of data systems for aviation units down to battalion level that can interface with CTAPS, or its follow on systems, for submission of airspace control requests and receipt of relevant airspace control documents. The intent is not to circumvent the chain of command, but to better coordinate the execution of the missions the chain of command has directed.

-Modification of the BCE table of organization and equipment to include aircraft systems experts who may effectively coordinate and negotiate with other aircraft systems representatives within the J/CAOC.

The Army's future acquisition of intelligence and attack systems that require access to joint airspace requires a proportionate amount of doctrinal development for their application and integration into the joint environment. The tenets of Army

operations -- initiative, agility, depth, synchronization, and versatility -- should include an aggressive pursuit of jointly developed doctrine and operating procedures to maximize the Army's air assets' contribution to those tenets in an increasingly crowded above-ground battlespace.

ENDNOTES

[1] An Aerial Exploitation Battalion is actually a Military Intelligence Battalion (Aerial Exploitation). It operates the bulk of the fixed wing aircraft in the US Army, including Special Electronic Mission Aircraft (SEMA) such as the RC-12N Guardrail Common Sensor, Aerial Reconnaissance Low (ARL - a militarized De Havilland Dash 7), and unmanned aerial vehicles (UAVs).

[2] CTAPS, the contingency tactical airspace control system automated planning system replaced CAFMS, the computer assisted force management system, after operation Desert Storm.

[3] JSTARS is the joint surveillance, target attack radar system. Mounted on a militarized Boeing 707, JSTARS uses side-looking airborne radar and synthetic aperture radar to provide a near real time image of the battlefield. It can portray through its downlink to ground stations, large formations of vehicles, their direction and speed of movement, and whether they are wheeled or tracked at distances well beyond the forward line of own troops.

[4] An O7 is a Brigadier General.

[5] "The coordinating altitude is a procedural airspace control method to separate fixed- and rotary wing aircraft by determining an altitude below which fixed-wing aircraft will normally not fly and above which rotary-wing aircraft normally will not fly. The coordinating altitude is normally specified in the airspace control plan and may include a buffer zone for small altitude deviations." Coordinating altitudes vary depending on many factors including the mission, threat, terrain, predominant weather, etc. During DS/DS the theater wide CA was set at 500' AGL. Currently, the coordination level (NATO term for coordinating altitude) in Bosnia is set at 3000' AGL. Joint Warfighting Center, JP 1-02, Department of Defense Dictionary of Military and Associated Terms, (23 March 1994), p. 93.

[6] Electronic intelligence is technical and geolocation intelligence derived from foreign non-communications electromagnetic radiations emanating from other than nuclear detonations or radioactive sources. (JP 1-02, p. 129.) I n the context of this vignette ELINT refers specifically to intelligence about enemy radars associated with air defense systems such as surface to air missiles and radar controlled anti-aircraft gun systems.

[7] Although not in total agreement with the Army definition, the joint definition contained in JP 1-02 is: "A line established by the appropriate ground commander to ensure coordination of fire not under the commander's control but which may affect current tactical operations. The fire support coordination line is used to support fires of air, ground, or sea weapons systems using any type of ammunition against surface targets. The fire support coordination line should follow well defined terrain features. The establishment of a fire support coordination line must be coordinated with the appropriate tactical air commander and other supporting elements. Supporting elements

may attack targets forward of the fire support coordination line without prior coordination with the ground force commander provided the attack will not provide adverse surface effects on or to the rear of the line. Attacks against surface targets behind this line must be coordinated with the ground force commander." (JP 1-02, p. 146.) The placement of the FSCL in a theater of operations is contentious because placing it too close to the forward line of troops (FLOT) may impede the ground commander's ability to maneuver, and his ability to affect with fires, those targets within his battlespace. Conversely, the Air Force perceives that a FSCL close to the FLOT gives airpower more flexibility in planning and executing air interdiction. A FSCL placed relatively distant from the FLOT gives the ground commander maneuver space, but can unduly hamper the air commander's ability to fight the air superiority and interdiction battles.

[8] Headquarters, Department of the Army, TRADOC Pamphlet 525-200-5, Depth and Simultaneous Attack, (1 June 1994), p. 2.

[9] Headquarters, Department of the Army, FM 100-5, Operations, (June 1993), p. 2-18.

[10] Ibid., p. 2-2.

[11] Battlespace is defined as a physical volume that expands or contracts in relation to the ability to acquire and engage the enemy. It includes the depth, breadth, and height in which the commander positions and moves assets over time. Ibid., p. 6-12.

[12] Headquarters, Department of the Army, FM 100-103, Army Airspace Command and Control in a Combat Zone, (October 1987), p. iii.

[13] Ibid.

[14] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP/ 50-38/PACAFP 50-38, ICAC^2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. 4-4.

[15] CW4 Daniel S. Rowlands, Airspace Coordination and Communications for Army Special Electronic Mission Aircraft (SEMA), (Paper submitted to the U.S. Army Fixed-Wing/SEMA Conference, Fort Huachuca, AZ, 17 August 1992), p. 4.

[16] Ibid., p. 5.

[17] Memorandum For Commander, U.S. Army Training and Doctrine Command, Fort Monroe, Virginia (undated), from Commandant, US Army Field Artillery School, Fort Sill, Oklahoma, Subject: Battlefield Coordination Element (BCE) Manning.

[18] Headquarters, Department of the Army, FM 100-103, Army Airspace Command and Control in a Combat Zone, (October, 1987), p. 2-24.

[19] "*Restricted operations area* (ROA) and *restricted operations zone* (ROZ) are synonymous terms for defining a volume of airspace set aside for a specific operational mission or requirement. These areas or zones restrict some or all airspace users until termination of the mission. The airspace is usually used for drop or landing zone activity, search and rescue operations, SEMA, and so forth." Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/PACAFP 50-38, ICAC2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. E-1.

[20] Ibid., p. 2-25.

[21] Ibid., p. 2-23.

[22] Ibid., p. 2-24.

[23] Ibid., p. 2-24.

[24] Joint Warfighting Center, JP 3-52, Doctrine for Joint Airspace Control in the Combat Zone, (July 1995), p. v.

[25] Ibid., p. vii.

[26] Ibid., p. vi.

[27] Ibid., p. v.

[28] Headquarters, Department of the Army, FM 100-103-1, ICAC^2, Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. F-1.

[29] Joint Warfighting Center, JP 3-52, Doctrine for Joint Airspace Control in the Combat Zone, (July 1995), p. I-3.

[30] Ibid., p. I-4.

[31] CW4 Daniel S. Rowlands, Airspace Coordination and Communications for Army Special Electronic Mission Aircraft (SEMA), (Paper submitted to the U.S. Army Fixed-Wing/SEMA Conference, Fort Huachuca, AZ, 1993), p. 5.

[32] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/PACAFP 50-38, ICAC^2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p.1-2.

[33] Joint Warfighting Center, JP 3-52, Doctrine for Joint Airspace Control in the Combat Zone, (July 1995), p. II-3.

[34] *All missions* implies all aircraft flying within airspace controlled by the Airspace Control Authority. Joint Warfighting Center, JP 3-56.1, Command and Control for Joint Air Operations, (August 1993), p. V-5.

[35] Ibid., p. iv.

[36] Joint Warfighting Center, JP 1-02, Department of Defense Dictionary of Military and Associated Terms, (March 1994), p. 117.

[37] Headquarters, Department of the Army, FM 100-103-2/FMFRP 5-62/NDC TACNOTE 3-56.2/ACCP 50-54/PACAFP 50-54/USAFEP 50-54, TAGS: Multiservice Procedures for the Theater Air-Ground System, (31 October 1994), p. 19.

[38] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/PACAFP 50-38, ICAC2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (3 October 1994), p. A-3.

[39] Department of the Air Force, AF Manual 1-1 (Vol. 1), Basic Aerospace Doctrine of the United States Air Force, (March 1992), p. 6.

[40] Headquarters, U.S. Air Force Air-Ground Operations School, USAFAGOS Brochure, (1992), p. 14.

[41] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/PACAFP 50-38, $ICAC^2$: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. 1-4.

[42] Command and Control Directorate, U.S. Army Combined Arms Command, Army Airspace Command and Control (A2C2) Action Plan for Issue Resolution, (September 1993), p. 4-12.

[43] Ibid., p. 5-5.

[44] Headquarters Department of the Army, FM 100-103, Army Airspace Command and Control in a Combat Zone, (October 1987), p. 1-14.

[45] Headquarters, United States Army Training and Doctrine Command, TRADOC PAMPHLET 525-200-4, Mounted Battlespace, (1 June 1994), p. 6.

[46] Command and Control Directorate, U.S. Army Combined Arms Command, Army Airspace Command and Control (A2C2) Action Plan, (September 1993), p. A-23.

[47] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/PACAFP 50-38, ICAC2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. A-4.

[48] The functions of the A2C2 section in the BCE are:

1. Coordinate Army airspace use requirements with the AOC operations and plans division or Naval TACC afloat, if appropriate.

2. Coordinate joint force requirements for use of Army airspace with the appropriate land component A2C2 element.

3. Integrate Army airspace user activities with the AOC airspace plans.

4. Advise the chiefs of the AOC and BCE of significant activities that affect the joint use of airspace.

5, Advise the airspace control authority (ACA) and the BCE chief on the affect that joint airspace control measures or restrictions have on the conduct of the ground battle.

6. Represent the ground force interests in the development and approval of airspace control measures and restrictions.

7. Receive, for staffing and approval, all Army requests for airspace control measures and restrictions.

8. Provide timely and complete distribution of the airspace control order (ACO) to all ARFOR staff elements that need it.

9. Monitor the integration of Army air traffic service (ATS) facilities into the AOC's airspace control system.

10. Provide the ACA with the location and status of Army airfields, navigational aids, ATS facilities, and A2C2 control measures.

11. When intelligence and electronic warfare systems operations are requested, coordinate with AOC airspace management to obtain airspace and ensure SEMA and UAV missions are scheduled into the daily ATO. Coordinate changes in mission requirements through AOC airspace management operations.

12. When operational support airlift (OSA) is requested, coordinate with AOC airspace management to obtain airspace and ensure OSA missions are scheduled into the daily ATO. Coordinate changes in mission requirements through AOC airspace management operations.

13. Monitor the integration of the ground commander's A2C2 procedures into the AOC's airspace control system. (Army Airspace Command and Control Action Plan , September 1993, p. A-35 - A-34.)

[49] Command and Control Directorate, U.S. Army Combined Arms Command, Army Airspace Command and Control (A^2C^2) Action Plan for Issue Resolution, (September 1993, p. A-36.

[50] MG Marcus Hurley, "JFACC: Taking the Next Step," *Joint Force Quarterly* (Washington, DC: Institute for National Strategic Studies, National Defense University, Spring 1995), p. 63.

[51] Command and Control Directorate, U.S. Army Combined Arms Command, Army Airspace Command and Control (A^2C^2) Action Plan for Issue Resolution, (September 1993), p. A-14 - A-15.

[52] CPT Hector R. Valle, "Army Airspace Command and Control," *Air Defense Artillery* (Texarkana, TX: Image Southwest, March-April 1993), p. 29.

[53] Ibid.

[54] Headquarters, United States Army Training and Doctrine Command, TRADOC Pamphlet 525-200-4, Mounted Battlespace, (11 June 1994), p. 6-7.

[55] James A. Winnefeld and Dana J. Johnson, Command and Control of Joint Air Operations: Some Lessons Learned from Four Case Studies of an Enduring Issue, (Santa Monica, CA: RAND Corporation, 1991), p. vii.

[56] Robert R. Ropelewski, "Planning, Precision, and Surprise Led to Panama Success," *Armed Forces Journal International*, (February 1990), p. 28.

[57] Ibid., p. 30.

[58] The total number of missions flown during both operations was in the thousands. The number of combat missions flown by various Army fixed-wing aircraft during Desert Storm is as follows:

C-12	183
C-23	3
OV-1D	161
RV-1D	111
RU-21H	242
RC-12D	216
TOTAL	916

Thomas A. Keaney and Eliot A. Cohen, Gulf War Air Power Survey Summary Report, (Washington, DC: U.S. Government Printing Office, 1993), p. 184.

[59] COL Richard Roy, Joint Uniform Lesson Learned System (JULLS), number 03560-96200(00033), Airspace, (3 May 1991).

[60] Ibid.

[61] Headquarters, Department of the Army, Aviation Branch Desert Shield/Storm Special Study Project, (Fort Rucker, AL: U.S. Army Aviation Center and Fort Rucker, 27 June 1991), p. C-24.

[62] Ibid.

[63] Ibid.

[64] Ibid.

[65] Department of the Army, Headquarters VII Corps, Memorandum For Director, Desert Storm Special Study Project, Fort Leavenworth, KS, 26 June 1991.

[66] Ibid.

[67] PARPRO stands for peacetime aerial reconnaissance program and was the source of operational missions for all but two of the Army's six aerial exploitation battalions prior to DS/DS. During Operation Desert Shield, PARPRO rules were used to coordinate flight tracks for aircraft on intelligence collection missions in close proximity to the Iraq and Kuwait borders.

[68] COL Richard Roy, Joint Uniform Lesson Learned System (JULLS), number 03482-60200(00022), Airspace Management in the BCE, (3 May 1991).

[69] CPT Brown, Joint Uniform Lessons Learned System (JULLS), number 51553-53000(00001), Joint and Combined Liaison, (1 August 1990).

[70] CPT Yates, Joint Uniform Lessons Learned System (JULLS), number 13443-44800(00002), Lack of Knowledge About Airspace, (3 April 1991).

[71] ARCENT Military Intelligence History, Chapter 9, section VI: Lessons Learned Narrative and JULLS, p. 9-25.

[72] COL Richard Roy, Joint Universal Lessons Learned System (JULLS), number 03459-88400(00003), Dissemination of Theater Airspace Information, (3 May 1991).

[73] Headquarters, Department of the Army, FM 100-103-1/FMFRP 5-61/NDC TACNOTE 3-52.1/ACCP 50-38/USAFEP 50-38/ PACAFP 50-38, ICAC^2: Multiservice Procedures for Integrated Combat Airspace Command and Control, (October 1994), p. B-8.

[74] MG Marcus Hurley, JFACC: Taking the Next Step, *Joint Force Quarterly* (Washington, DC: Institute for National Strategic Studies, National Defense University, Spring 1995), p. 63.

[75] Center for Army Lessons Learned, Joint Tactical Communications: Operations Desert Shield and Desert Storm: Newsletter No. 92-1, (Fort Leavenworth, KS: CAC January 1992), p. 18.

[76] Ibid., p. 2.

[77] Department of the Army, Headquarters, Third Armored Division, Memorandum for Commander V Corps, Subject : Operation Desert Shield/Desert Storm Spearhead Lessons Learned, (6 April 1991).

[78] Fragger is a term used to describe an aviator/pilot from any service attached to the JAOC to deconflict airspace, and to draft fragmentary orders (frags) for inclusion in the ATO. The frags contain callsigns, transponder codes, station times, control measures, entry points, and frequencies and call signs for the controlling agency in the target area.

CW4 Daniel S. Rowlands, Airspace Coordination and Communications for Army Special Electronic Mission Aircraft (SEMA), (Paper submitted to the U.S. Army Fixed-Wing/SEMA Conference, Fort Huachuca, AZ, 17 August 1992), p. 8.

[79] Catherine Lennon, Blue Flag -- Air Force Exercises for Theater Interoperability, *Field Artillery*, (Fort Sill, OK: Headquarters, Department of the Army, U.S. Army Field Artillery School, February 1993), p. 27-29.

[80] Coordination level is the NATO term for coordination altitude.

[81] Department of the Army, Pamphlet 10-1, Organization of the United States Army, (14 June 1994), p. 1.

[82] Ibid., p. 3.

[83] Department of the Air Force, Air Force Manual 1-1, Basic Aerospace Doctrine of the United States Air Force, (March 1992), p. 6.

[84] James A. Winnefeld and Dana J. Johnson, Command and Control of Joint Air Operations: Some Lessons Learned from Four Case Studies of an Enduring Issue, (Santa Monica, CA: RAND Corporation, 1991), p. vi.

[85] Headquarters, Department of the Army, FC 101-55, Corps and Division Command and Control, (28 February 1985), p. 3-1 - 3-2.

[86] LTC C. Kenneth Allard, Command and Control and the Common Defense, (New Haven, CN: Yale University Press, 1990), p. 185.

[87] Headquarters, Department of the Air Force, AF Manual 1-1, Basic Aerospace Doctrine of the United States Air Force, (16 March 1984), p. 4-2.

[88] CDR Michael C. Vitale, "Jointness by Design Not Accident," *Joint Force Quarterly*, (Washington, DC: Institute for National Strategic Studies, National Defense University, November 1995), p. 25.

[89] Ibid.

[90] Headquarters, Department of the Army, TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for he Strategic Army of the Early Twenty-First Century, (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1 August 1994), p. 3-2.

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